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High resolution DNS studies of long-time behavior of homogeneous turbulent shear flow PARVEZ SUKHESWALLA, T. VAITHIANATHAN, LANCE R. COLLINS, Cornell University — As discussed in Isaza & Collins [*J. Fluid Mech.* **678**:14–40, 2011], the shear parameter S^* has a pronounced effect on velocity gradient statistics for homogeneous turbulent shear flow (HTSF). Due to the importance of this effect, especially for higher S^*, we extended those studies to higher resolution using a new direct numerical simulation (DNS) code based on a pseudospectral algorithm that avoids remeshing [Brucker et al., *J. Comp. Phys.* **225**:20–32, 2007], and decomposes the domain into "pencils". We present DNS with $2048 \times 1024 \times 1024$ grid points, achieving a maximum Taylor microscale Reynolds number of 300. The peak in the initial energy spectrum, viscosity, and box configuration also have been optimized to maximize the time window for well-resolved simulations (up to $St = 20$), ensuring we are well into the asymptotic regime. The DNS runs confirm the sensitivity of the large- and small-scale statistics to S^*, as was found by Isaza & Collins. We also investigated the interaction between the fluctuating vorticity vector and rate-of-strain tensor as a function of scale, and find alignments vary dramatically, suggesting the primary source of enstrophy is at large scales, followed by a forward cascade to small scales. This helps explain the persistent sensitivity of the velocity gradient statistics to S^*. The combination of results suggests a new framework for modeling HTSF at high values of S^*.

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